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# Diffuse gas in retired galaxies: Nebular emission templates and constraints on the sources of ionization

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## Abstract

© 2016 The Authors.We present emission-line templates for passively-evolving ('retired') galaxies, useful for investigation of the evolution of the interstellar medium in these galaxies, and characterization of their high-temperature source populations. The templates are based on high signal-tonoise (>800) co-added spectra (3700-6800 Å) of ~11 500 gas-rich Sloan Digital Sky Survey galaxies devoid of star formation and active galactic nuclei. Stacked spectra are provided for the entire sample and sub-samples binned by mean stellar age. In our previous paper, Johansson et al., these spectra provided the first measurements of the He II 4686 Å line in passively-evolving galaxies, and the observed He II/Hß ratio constrained the contribution of accreting white dwarfs (the 'single-degenerate' scenario) to the Type Ia supernova rate. In this paper, the full range of unambiguously detected emission lines are presented. Comparison of the observed [OI] 6300 Å/Ha ratio with photoionization models further constrains any high-temperature single-degenerate scenario for Type Ia supernovae (with 1.5 ≲ T/105 K ≲ 10) to ≲3-6 per cent of the observed rate in the youngest age bin (i.e. highest SN Ia rate). Hence, for the same temperatures, in the presence of an ambient population of post-asymptotic giant branch stars, we exclude additional high-temperature sources with a combined ionizing luminosity of ~1.35 × 1030 L⊙/M⊙,* for stellar populations with mean ages of 1-4 Gyr. Furthermore, we investigate the extinction affecting both the stellar and nebular continuum. The latter shows about five times higher values. This contradicts isotropically distributed dust and gas that renders similar extinction values for both cases.

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## Keywords

CD-galaxies, Elliptical and lenticular, Galaxies, ISM